REALIZATION AND MANAGEMENT OF MOLISE REGION PEDOLOGICAL CARTHOGRAPHY WITH GEOGRAPHICAL INFORMATION SYSTEM

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Abstract

The realization of this important project, begun in 1992, has involved the collaboration of Molise Region Aldemanry Agricultural and Forest officials, researchers of both Animal, Vegetal and Environmental Science Department of Molise University and Experimental Centre for Analysis and Soil Study of Bologna University as well as some companies specialized on carthography, remote sensing and geographical information system. The amount of informations collected for the realization of this study, the comparative analysis of different environmental factors and the organization of the results of the investigations on thematic maps, represents a remarcable example in national extent and a prominence heritage for researchers operating in territorial resources management [1]. The project has lead to the realization of land-units map and soils map both on scale 1:100000. Management and realization of these products have been obtained by use of GIS [2].

1 Land-Units and soils maps

In the preliminary phase of the project (which has interested an area of 4438 square kilometers corresponding to Molise region territory, located in southern Italy), syntesis of four environmental factors has been done (altimetry, slope, land-use and lithology): by the correlation of them [3] has been possible to individualize, inside regional territory, different areas called land-units (see figure 1). With these tools, basis for the beginning of pedological works have been fixed, in the direction of a rational survey instead of a generalized one. Observations have been done by excavation of holes for the observation of speciment profiles or by smooth samples made by screw drill. Both field and analytical data have been collected on schedules and then stored with a fit software. The informations have permitted the classification of available speciment profiles and then, the elaboration of soils map and correlated legend (see figure 2). Soils map has been organized in carthographic units, each one defined by FAO - UNESCO classification [4].

2 Procedure

Different phases which have carried out to final results are the followings:
- digitalization,
- plotting control,
- topology creation,
- database project,
- analysis,
- legends project,
- plotting files.

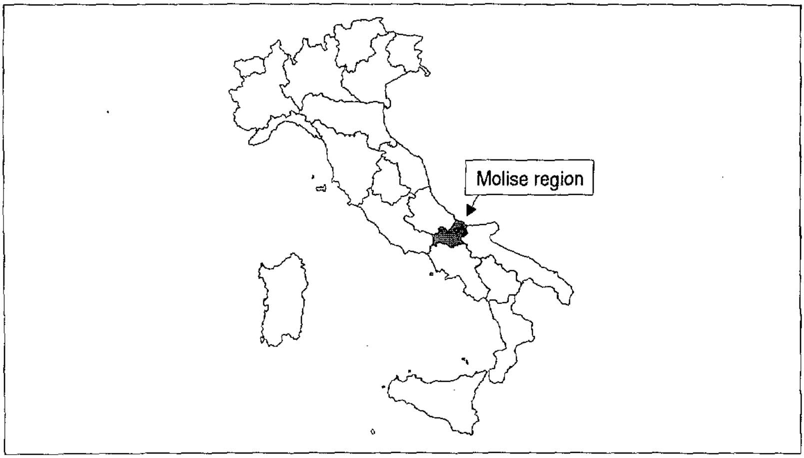

Figure 1: Localization of the study area in southern Italy.

ALTIMETRY
(height above sea level)

- 0 - 2
- 2 - 100
- 100 - 900
- 900 - 1400
- > 1400

SLOPE
(in percent)

- < 10
- 10 - 35
- > 35

LAND-USE

- Prevaling woody covering and irregular presence of bush and arboreous meadow.
- Herbaceous and arboreous cultivations.
- Woody formations or presence of bush and occasional arboreous.
- Arboreous and herbaceous cultivations sometimes with untilled lands.
- Meadows, pastures and arboreous pastures.
- Arboreous and herbaceous cultivations with irregular presence of meadow-pasture areas.
- Woody formations or presence of bush within meadow areas.

Sandstones, sandy-marly calacareous complex, meadows, pastures and arboreous pastures, limited slope (10-35%) and hill areas between 100 and 900 m above sea level.

LITHOLOGY

River sands or from coastal elaboration.	Recent and terraced drift.	Detritus of water-bearings cones and conglomeratus.	Sandstones, sandy-marly calcareous complex.	Limestones, dolomites, travertines, gypsums.	Vari coloured clays, clays and marly clays.

Table 1: Example of land-unit legend.

2.1 Digitalization

The digitalization of land-units maps has been laboured cause of different reasons: times of acquisition, character detail level (almost 4000 polygons for the whole regional territory) descriptive attribute complexity, etc. In addition to digitalization of limits (arcs), polygon labels have been stored to facilitate subsequent control operations and identity codes automatic assignment, during topology creation.

2.2 Plotting control

Digitalized elements inspection represents an important moment from which, success of produced maps and subsequent analysis, might depend. For each plotted sheet, different colours have been used in order to distinguish arcs and labels; by superimposion with the original map on bright drawing-board, different kinds of mistakes have been individuated: not correct connections between sheets and doubtful interpretations on original map; operators omissions of both arcs (open polygons with different labels) and labels (empty polygons). Each correction has been digitalized again on original file.

2.3 Topology creation

Topology represents a set of rules to clearly define spatial relationships between cartographic objects. Its creation gives many advantages, like for instance, a more efficient data organization and a faster analysis of great amount of informations. Besides, topology facilitates analysis functions and, in case of polygonal primitives, the combination of adjacent or included elements with similar characteristics; identification and selection of groups of polygons; intersection with elements already present in others coverages or with others graphics primitives (lines or points); generalization, query, etc. Topology management is completely supported by software which organizes data, following its properly structure made by binary files and dBase format tables.

2.4 Database project

After the production of land-units maps, through accords with planners and coordinators, one by one, requisites for database planning and construction, has been defined to originate furthers characters. Database consist of some relation tables between geographical elements and corresponding attributes; these latest has been sometimes derived from maps themselves or from working intermediate maps, sometimes created from the beginning, or imported from ascii files compiled by planners.

2.5 Analysis

By functions presents in GIS, new relations between acquired characters and tables have been created; new attributes on maps elements have been associated (reclassification); two or more characters have been intersected to originate intermediate informations or final maps (overlay). This operation is not complex because is software itself that manages different operations. Attention must be observed for their correct structuring (also through the aid of flow charts), and to levels organization which make up final plotting map. Besides that, it is necessary a good experience to make automatic procedures. For instance, to the realization of a single character, hundred instructions are usually demanded; these results extremely repetitive and often, between two subsequent commands, computer takes time for the elaboration or the visualization of images; therefore it is necessary to apply macro (series of commands joined together in one command or file), or better, real programs able to perform the work quickly, reducing operator casual mistakes, or in moments of the day in which computers are available.

MAJOR SOIL GROUPING	SOIL UNITS	CODES
ARENOSOLS	Gleyic Arenosols	[ARg]
	Calcaric Cambisols	[CMc]
	Dystric Cambisols	[CMd]
	Eutric Cambisos	[CMe]
CAMBISOLS	Gleyic Cambisols	[CMg]
	Humic Cambisols	[CMu]
	Vertic Cambisols	[CMv]
	Calcaric Fluvisols	[FLc]
FLUVISOLS	Eutric Fluvisols	[FLe]
	Mollic Fluvisols	[FLm]
GLEYSOLS	Eutric Gleysols	[GLe]
	Eutric Leptosols	[LPe]
	Rendzic Leptosols	[LPk]
LEPTOSOLS	Mollic Leptosols	[LPm]
	Umbric Leptosols	[LPu]
	Calcic Luvisols	[LVk]
LUVISOLS	Chromic Luvisols	[LVx]
	Calcaric Phaeozems	[PHc]
	Gleyic Phaeozems	[PHg]
PHAEOZEMS	Haplic Phaeozems	[PHh]
	Luvic Phaeozems	[PHl]
	Calcaric Regosols	[RGc]
REGOSOLS	Eutric Regosols	[RGe]
	Umbric Regosols	[RGu]
	Eutric Vertisols	[VRe]
VERTISOLS	Calcic Vertisols	[VRk]

Table 2: Soils legend (From FAO-Unesco)

2.6 Legend project

Following a temporal sequence, this phase goes on a parallel way with database planning, because symbols and attributes appearing in legend, must be stored on a database; this phase is therefore more devoted to graphic composition, with a legend project directed to the choice of present elements arrangement, according to hierachies or reading priority, to the choise of colours, patterns, characters, etc. In these maps sometimes legends are not only a descriptive elements list of what is represented in carthographic frame, but they carry out as interpretative keys, whose meaning derives from various elements cross-related reading.

2.7 Plotting files

In this last phase, maps have been completed with all characteristics elements which compose a map, organized in several layers:

- cartographic base,
- limits of cartographic units,
- labels (both color and b/w versions),
- patterns and colours (full or articulated on different models).

In the preparation of files, a specific nomenclature has been used in names assignment, able to individuate on each sheet, different layers to be assembled, colours to be used, lines width, etc.

3 Conclusions

During this experience great advantage that GIS use presents has been possible to appreciate and maps represent a valid example. However, only a little of what is possible to do using this kind of system has been analysed. For instance, it can be possible to extract tabular informations relating to areas of a determinate character, considering whole regional territory or each single sheet or furthermore administrative circles (province, commune); to update database with new informations; to produce new cartographies on different scale; to execute some intersections with others informative levels, etc. In the end, it can be interesting to export coverages toward desktop systems, planned to give simple and intuitive answers to final GIS users.

References

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